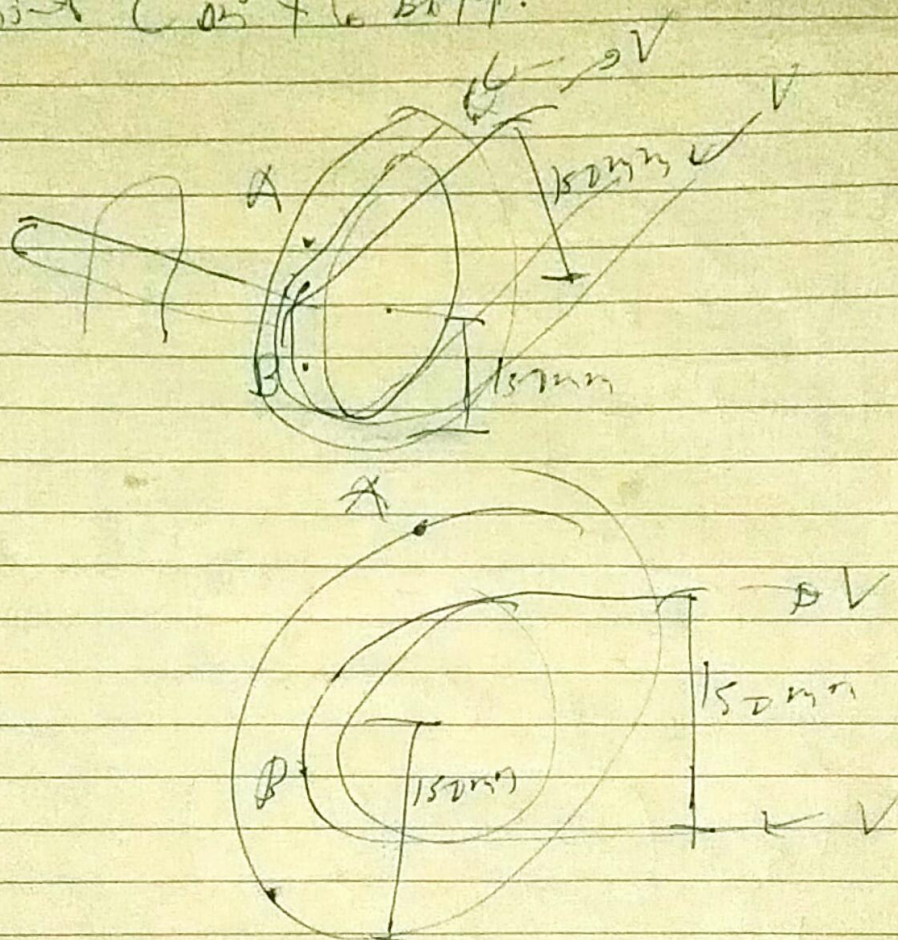


Daniel Kenneth Williamson
1838779

NO. _____
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The belt-driven pulley and attached disk are ~~now~~ rotating with increasing angular velocity. At a certain instant, the speed of the belt is 1.5 m/s and the total acceleration of point A is 75 m/s^2 . For this instant, determine (a) the angular acceleration α of the pulley and disk, (b) the total acceleration of point B, and (c) the acceleration of point C on the belt.



6) rev!

$$v \text{ of the belt} = 1.5 \text{ m/s}$$

$$\omega_{\text{total}} = 73 \text{ rev/s}$$

Solve for!

a) ω of pulley & disk

b) ω_{total} & AD

c) ω at C on the belt

Solution: velocity at point C

inner radius $v_c = r \omega$ — angular velocity

$$1.5 \text{ m/s} = \left(\frac{0.15}{2} \text{ m} \right) \omega$$

$$\omega = \frac{1.5 \text{ m/s}}{\frac{0.15}{2} \text{ m}} = 20 \frac{\text{rad}}{\text{s}}$$

Note!

$$\frac{\text{rad}}{\text{s}} = \frac{\text{rev}}{\text{s}}$$

$$v_A = \omega R \quad \text{at outer radius}$$

$$v_A = \left(20 \frac{\text{rad}}{\text{s}} \right) (0.15 \text{ m})$$

$$v_A = 3 \text{ m/s}$$

a) Acceleration of the pulley is high

NO. _____
DATE _____

$$a_A^2 = \underbrace{(R\alpha)^2}_{\text{tangential acceleration}} + \underbrace{\left(\frac{v_A^2}{R}\right)^2}_{\text{normal acceleration}}$$

$$(75 \text{ m/s}^2)^2 = (0.15 \text{ m} \cdot \alpha)^2 + \left(\frac{(3.5)^2}{0.15}\right)^2$$

$$5625 = 0.0225 \alpha^2 + 3600$$

$$5625 - 3600 = 0.0225 \alpha^2$$

$$\sqrt{\frac{5625 - 3600}{0.0225}} = \alpha$$

$$\alpha = 370 \frac{\text{rad}}{\text{s}^2}$$

b) acceleration of P:

$$a_P^2 = (r\alpha)^2 + \left(\frac{v_P^2}{r}\right)^2$$

$$a_P = \sqrt{(r\alpha)^2 + \left(\frac{v_P^2}{r}\right)^2}$$

$$a_P = 37.5 \text{ m/s}^2$$

C) Acceleration on point C

$$a_c = r \omega$$

$$a_c = (0.075 \text{ m}) \left(300 \frac{\text{rad}}{\text{s}^2} \right)$$

$$a_c = 22.5 \frac{\text{m}}{\text{s}^2}$$